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IS 14218 (1994): Sealed cylindrical type rechargeable nickel cadmium cells [ETD 11: Secondary Cells and Batteries]

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Indian Standard

SEALED CYLINDRICAL TYPE RECHARGEABLE NICKEL CADMIUM CELLS — SPECIFICATION

UDC 621.355.82 — 434.1

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

November 1994

Price Group 3

Secondary Cells and Batteries Sectional Committee, ET 11

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Secondary Cells and Batteries Sectional Committee (ET 11), had been approved by the Electrotechnical Division Council.

The primary object of this Indian Standard is to apply and gain experience on the methods specified in the International/Defence Standard.

This standard covers the requirements and tests for sealed cylindrical type rechargeable nickel cadmium cells, suitable for use in any position.

In the preparation of this standard, assistance has been derived from the following:

a) IEC Publication 285(1983) 'Sealed nickel cadmium cylindrical rechargeable single cells', published by the International Electrotechnical Commission (IEC).

b) JSS 6140-03 'Batteries — Secondary nickel cadmium (DS Class 6140)', published by the Ministry of Defence.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the results of a test, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

SEALED CYLINDRICAL TYPE RECHARGEABLE NICKEL CADMIUM CELLS — SPECIFICATION

1 SCOPE

1.1 This Indian Standard covers the requirements and methods of test for sealed cylindrical type rechargeable nickel cadmium cells, suitable for use in any position.

2 REFERENCES

2.1 The Indian Standards given in Annex A are necessary adjuncts to this standard.

3 TERMINOLOGY

For the purpose of this standard the definitions given in IS 1885 (Part 8) : 1965 and IS 8320 : 1982 in addition to the following shall apply.

3.1 Sealed Cells

Sealed cells are cells which are designed to operate during their life, without any addition of electrolyte while in use, in their original sealed condition. These cells do not release gas under normal charging and temperature conditions specified by the manufacturer. The cells are equipped with safety devices to prevent dangerously high internal pressure.

3.2 Type Test

Tests carried out to prove conformity with requirements of this standard. These are intended to prove general quality and design of a given type of cell.

3.3 Acceptance Test

Tests carried out on samples selected from a lot for the purpose of verifying the acceptability of a lot.

3.3.1 *Lot*

All cells of same type, design and rating manufactured by the same factory during same period using the same process and materials, offered for inspection at a time shall constitute a lot.

3.4 Routine Test

Tests carried out on each cell to check the requirements which are likely to vary during production.

4 CELL DESIGNATION

4.1 Sealed cylindrical type rechargeable nickel cadmium cells shall be designated by the letters KR followed by one of the letters:

L — for low rate of discharge.
M — for medium rate of discharge.
H — for high rate of discharge.

It shall be followed by two groups of figures separated by a solidus. The first two figures to the left of solidus shall indicate the whole number equal to or immediately above the maximum diameter specified for the cell, expressed in millimetres.

The two figures to the right of the solidus shall indicate the whole number equal to or immediately above the maximum height specified for the cell, expressed in millimetres.

Example:

KR 35/62

When a manufacturer designs a cell with tolerances which make it interchangeable with a primary cell, the designation of the primary cell may also be indicated on the cell.

Example, when applicable:

KR 35/62 (R20) (*see* Note)

NOTE — If the primary cell designation is used, the cell should also conform to the dimensions specified in IS 203 : 1984, IS 2576 : 1975 and IS 8144 : 1976 primary cell/batteries.

4.2 Cell Termination

The following alternative termination may be employed for sealed cylindrical type rechargeable nickel cadmium cells.

4.2.1 *Connection Free Cells (CF)*

The absence of connection tabs attached shall be designated by letters (CF) (*see* Fig. 1).

Example:

KRL 35/62 CF

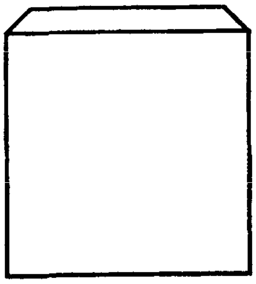

FIG. 1 CONNECTION FREE CELLS KR . . . CF

4.2.2 Cell with connection tabs on the cover and along the length HH. In this configuration or connections, tab shall be attached to the cover (positive pole) and another connection, tab shall be attached along the length of cylindrical wall of the cell (negative pole) both in the same plane (*see* Fig. 2). Cells positioned side by side in the same direction shall be capable of being connected in series so as to constitute batteries of different voltage. In this case the designation shall be HH.

Example:

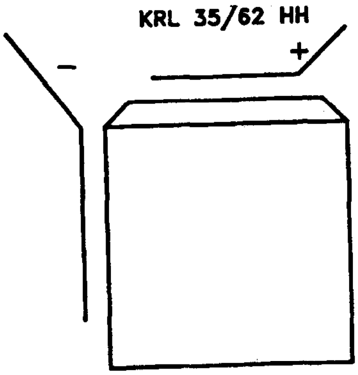

FIG. 2 HEAD-HEAD CONFIGURATION KR...HH

4.2.3 *Cells with Connection Tabs on the Cover and on the Base HB*

In this configuration, a connection tab shall be attached to the cover (positive pole) and another connection tab to the base of the cell (negative pole) parallel and in opposite directions (*see* Fig. 3). Cells positioned side by side and arranged head to base shall be capable of being connected in series so as to constitute batteries of different voltages. In this case designation shall be HB.

Example:

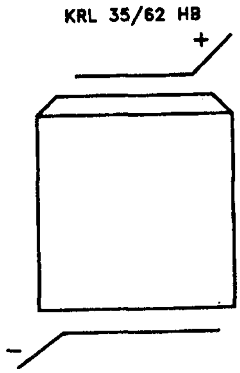

FIG. 3 HEAD-BASE CONFIGURATION KR...HB

5 RATINGS AND DIMENSIONS

5.1 Nominal Voltage

The nominal voltage of a single cell shall be 1.2 V.

5.2 Rated Ampere-Hour Capacity

The rated capacity in ampere-hours (after correction to 20°C) is the capacity at 5 hour rate discharge when tested in accordance with, shall be not less than the capacity declared by the manufacturer.

5.3 Dimensions

The dimensions of cells are shown in Table 1. These can be used with or without jackets and also with or without connecting tabs. The thickness of the jacket, if fitted, comes within the tolerances.

Table 1 Sealed Cylindrical Type Rechargeable Nickel Cadmium Cells (Jacketed or Unjacketed)

Designation	Diameter (mm)		Height (mm)	
KR 11/45	10.5		44.5	
KR 12/30	12.0		30.0	
KR 15/18	14.5		18.0	
KR 15/29	14.5		29.0	
KR 15/32	14.5		32.0	
KR 15/51	14.5		50.5	
KR 17/51	16.5	0	50.5	
KR 18/18	17.5	−1.5	17.6	
KR 18/29	17.5		28.5	0
KR 18/51	17.5		50.5	−2.0
KR 23/27	23.0		26.4	
KR 23/43	23.0		42.8	
KR 27/33	26.2		32.8	
KR 27/50	26.2		50.0	
KR 35/44	34.2		44.0	
		0		
KR 35/62	34.2	−2.0	61.5	
KR 35/92	34.2		91.3	
		0		0
KR 44/91	43.5	−3.0	91.0	−3.0

NOTE — The letters KR to be followed by L, M or H as appropriate (*see* 4.1).

The dimensions of the cells are shown in Table 2 which are interchangeable with primary cells as specified in IS 203 : 1984, IS 2576 : 1975 and IS 8144 : 1976. The jacket comes within these tolerances.

6 MARKING AND PACKING

6.1 Marking

Each cell supplied without connections (CF termination) shall be marked giving the following information, except when otherwise required by the purchaser:

a) Indication of the source of manufacture;
b) Month and year of manufacture;
c) Sealed, rechargeable nickel cadmium cell;
d) Rated capacity;
e) Nominal voltage;
f) Recommended charge rate and time;
g) Polarity;
h) Cell designation; and

Table 2 Sealed Cylindrical Type Rechargeable Nickel Cadmium Cells Which are Interchangeable with Primary Cells
(*Clause* 5.3)

Designation	Corresponding Primary Battery (Ref IS 203 : 1984, IS 2576 : 1975 and IS 8144 : 1976)	Diameter mm	Height mm	Minimum Height for Positive Terminal mm
*KR 15/51	R6	$14.5\ ^{0}_{-1.0}$	$50.5\ ^{0}_{-1.5}$	1.0
*KR 27/50	R14	$26.2\ ^{0}_{-1.5}$	$50.0\ ^{0}_{-1.5}$	1.5
*KR 35/62	R20	$34.2\ ^{0}_{-2.0}$	$61.5\ ^{0}_{-2.0}$	1.5

NOTE — The overall dimensions specified are for jackets only and do not include the terminals.

*The letters KR to be followed by L, M or H as appropriate (*see* 4.1).

j) Country of origin.

6.2 BIS Certification Marking

The product may also be marked with Standard Mark.

6.2.1 The use of the Standard Mark is governed by the provisions of Bureau of Indian Standards Act, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

6.3 Packing

The cells shall be suitably packed so as to avoid any damage during transit.

7 CONDITION OF SUPPLY

7.1 Conditions of supply shall be subject to agreement between the purchaser and the supplier. It is recommended that purchaser should furnish information regarding his requirements giving specific details about the following:

a) Ampere-hour capacity,
b) Nominal voltage of a battery,
c) Mass,
d) Size,
e) Application of cells/batteries, and
f) Type of the cell.

7.2 The battery shall have fast changing capability as recommended by the supplier and should be capable of being changed for any state of discharge.

8 TESTS

8.1 Classification of Tests

8.1.1 *Type Tests*

The type tests shall be chosen from the following:

a) Dimensions (8.2),
b) Marking (8.3),
c) Polarity and absence of short circuit (8.4),
d) Ampere-hour capacity (8.6),
e) Discharge performance at low temperature. (8.7),
f) Retention of charge (8.8),
g) Life cycle test (8.9),
h) Overcharge test (8.10),
j) Safety device operation (8.11),
k) Storage (8.12), and
m) Environmental tests (8.13).

NOTE — Test (m) is required only for special applications mainly for defence purposes except drop test (8.13.6) and bump test (8.13.8) which would be applicable to all applications.

8.1.1.1 Type test shall be carried out on not less than five samples drawn at random by the inspecting or testing authority and the sequence of type tests shall be in accordance with individual specification.

8.1.1.2 If any sample fails in the relevant type test the testing authority may call fresh samples not exceeding twice the original number and subject them again to the tests in which failure occurred. If there is any failure in retests, the type shall be considered as not having passed the requirements.

8.1.2 *Acceptance Tests*

The following shall constitute acceptance tests:

a) Dimensions (8.2),
b) Marking (8.3),
e) Polarity and absence of short circuit (8.4),
d) Ampere-hour capacity (8.6), and
e) Retention of charge (8.8).

8.1.2.1 The battery shall be capable of being stored at any temperature between 70°C to −30°C without any damage and also capable of operating between temperature range of +55°C to −30°C.

8.1.3 *Routine Tests*

The following shall constitute the routine tests:

a) Dimensions (8.2)
b) Marking (8.3), and
c) Polarity and absence of short circuit (8.4).

8.1.4 *Test Equipment*

The test equipment for carrying out the tests specified in this standard shall be in accordance with the requirements of **5.2** of IS 8320 : 1982.

8.2 Dimensions

The cell shall be examined for conformity with the requirements of **5.3**.

8.3 Marking

The cells shall be examined for conformity with the requirements of **6.1**.

8.4 Polarity and Absence of Short Circuit

This shall be checked by checking the terminal voltage of each cell electrically.

8.5 Charging

8.5.1 Unless otherwise stated in this standard, the charging procedure for test purposes shall be carried out at an ambient temperature of 20 ± 5°C at a constant current of 0.1 C_5 A for 16 hours.

8.5.1.1 Prior to charging, the cell shall have been discharged down to a voltage of 1.0 V at a constant current according to the manufacturer's instructions.

8.6 Ampere-Hour Capacity

8.6.1 The cell shall be first charged according to **8.5**.

8.6.2 After charging the cell shall be stored for not less than one hour and not more than 4 hours, at an ambient temperature of 20 ± 5°C.

8.6.3 The cell shall be discharged at a temperature of 20 ± 5°C as specified in Table 3. The duration of discharge shall not be less than the minimum specified in Table 3. In the case of the 0.2 C_5A discharge test 5 cycles are permitted. However, this test shall be terminated at the end of the first cycle which meets the requirements.

Table 3 Discharge Performance at 27°C

Discharge Conditions		Minimum Discharge Duration in Hours Minutes Cell Designation		
Rate of Constant Current	End Voltage	L	M	H
(A)	(V)			
0.2 C_5	1.0	4 h 45 min	4 h 45 min	4 h 45 min
1 C_5	1.0	—	42 min	48 min
5 C_5	0.8	—	—	6 min

8.7 Discharge Performance at Low Temperature

The cell shall be charged according to **8.5**. After charging the cell shall be stored in not less than 16 hours and not more than 24 hours at an ambient temperature of −18 ± 2°C. It shall be discharged at the same temperature and as specified in Table 4. The duration of discharge shall not be less than the minimum specified in Table 4.

Table 4 Discharge Performance at −18°C

Discharge Conditions		Minimum Discharge Duration in Hours Minutes Cell Designation		
Rate of Constant Current	End Voltage	L	M	H
(A)	(V)			
0.2 C_5	1.0	2 h	3 h	3 h
1 C_5	0.9	—	15 min	30 min
2 C_5	0.8	—	—	9 min

8.8 Retention of Charge

8.8.1 The cell shall be charged in accordance with **8.5**. The cell shall be stored on open circuit for 28 days without disturbance at 20 ± 5°C.

8.8.2 The cell shall then be discharged at 20 ± 5°C at a constant current of 0.2 C_5A to an end voltage of 1.0 V.

8.8.3 The duration of discharge after 28 days stored at 20 ± 5°C shall be not less than 3 hours 15 minutes.

8.9 Life Cycle Test

8.9.1 This test consists of cycles of charging and discharging performed at an accelerated rate.

Before this test the cell shall be discharged at 0.2 C_5A to an end voltage of 1.0 V.

8.9.2 The following life cycle test shall then be carried out irrespective of cell designation at an ambient temperature of 20 ± 5°C. Charge and discharge shall be carried out at a constant current throughout using the conditions specified in Table 5. Precaution shall be taken to prevent the cell case temperature from rising above +35°C during the test by providing a forced air draught if necessary.

8.10 Overcharge Test

The ability of the cell to withstand the overcharge shall be checked by this test.

8.10.1 The cell shall be charged at a constant current of 0.1 C_5A for 28 days at an ambient temperature of 20 ± 5°C.

8.10.2 After this charging operation the cell shall be stored for not less than 16 hours and not more than 24 hours at an ambient temperature of 20 ± 5°C.

Table 5 Life Cycle Test
(*Clause* 8.9.2)

Cycle Number	Charge	Stand in Charged Condition	Discharge
1	0.1 C_5A for 16 h	None	0.25 C_5 A for 2 h 20 min
2-48	0.25 C_5A for 3 h 10 min	None	0.25 C_5A for 2 h 20 min
49	0.25 C_5A for 3 h 10 min	None	0.25 C_5A For 1.0 V
50	0.1 C_5A for 16 h	1 h to 4 h	0.2 C_5A to 1.0 V*

*It is permissible to allow sufficient open circuit test time after the completion of discharge at cycle 50, so as to start cycle 51 at an exact two-weeks interval. A similar procedure may be adopted at cycles 100, 150, 200, 250, 300 and 350.

Cycle 1 to 50 shall be repeated until the discharge duration on any cycle becomes less than 3 h. At this stage, a further cycle as specified for cycle 50 shall be carried out.

The life cycle test shall be considered complete when two such successive cycles give a discharge duration less than 3 h. The number of cycles obtained when the test is completed shall not be less than 400.

Leakage of liquid shall not occur during the endurance test.

8.10.3 The cell shall then be discharged at 20 ± 5°C with a constant current of 0.2 C_5A to an end voltage of 1.0 V.

8.10.4 *Requirement*

The duration of discharge shall not be less than 4 hours 30 minutes. The leakage of liquid shall not occur during the overcharge test.

8.11 Safety Device Operation

The following test shall be carried out to establish that safety device of the cell shall allow escape of gases if the internal pressure exceeds a critical value under conditions of cell reversal.

8.11.1 The cell shall be discharged at an ambient temperature of 20 ± 5°C at a constant current of 0.2 C_5A to 0 voltage.

8.11.2 The cell shall then be forced discharged at a constant current of 1 C_5A for 30 minutes at the same ambient temperature of 20 ± 5°C.

8.11.3 *Requirement*

The cell shall not explode or disrupt during and at the end of this discharge. Leakage and deformation of the cell are acceptable.

8.11.4 *Caution*

Extreme caution should be exercised when carrying out this test. Cells should be tested individually and it should be noted that cells failing to meet requirement could disrupt with explosive force. For this reason, the test shall be carried out in a protective chamber.

8.12 Storage

8.12.1 Before this test, the cell shall be discharged at 0.2 C_5A to an end voltage of 1.0 V.

8.12.2 The cell shall then be stored on open circuit at a mean temperature of 27 ± 10°C and at a relative humidity not exceeding 90 percent for 12 months. Care shall be taken that during storage period, the ambient temperature shall not at any time fluctuate beyond the limits of 27 ± 10°C.

8.12.3 After completion of storage period, the cell shall then be charged according to **8.5**.

8.12.4 The cell then be stored for not less than 1 hour and not more than 4 hours at an ambient temperature of 20 ± 5°C.

8.12.5 The cell shall then be discharged at 0.2 C_5A to an end voltage of 1.0 V.

8.12.6 *Requirement*

The capacity obtained in any one of the first five cycles shall not be less than 4 hours 45 minutes.

8.13 Environmental Tests

Before the commencement of each environmental test the battery shall be fully charged. At the conclusion of each test visual examination shall be carried out for any damage or deformation. Individual cell voltages and the terminal voltages of the battery shall also be recorded on completion of each test. At the conclusion of all the environmental tests, the fully charged battery shall be subjected to the capacity discharge test at 5 h rate at room temperature. The capacity obtained shall not be less than the rated capacity in none of the above tests, the electrolyte should spill out.

8.13.1 *Vibration Test*

This test on the cells shall be carried out in accordance with IS 9000 (Part 8) : 1981 at a frequency range of 8-500 Hz with amplitude $\pm 15\ m/s^2$ constant acceleration for 3 planes for 10 hours.

8.13.2 *Dry Heat Test*

This test on the cells shall be carried out in accordance with IS 9000 (Part 3/Sec 1 to 5) : 1977 by exposing the cells at a temperature of 70°C for 16 hours.

8.13.3 *Damp Test*

The test on the cells shall be carried out in accordance with IS 9000 (Part 5/Sec 1) : 1981.

8.13.4 *Dust Test*

The test on the cells shall be carried out in accordance with IS 9000 (Part 12) : 1981.

8.13.5 *Low Air Pressure Test*

This test on the cells shall be carried out in accordance with IS 9000 (Part 13) : 1981 at a pressure of 60 KPa.

8.13.6 *Drop Test*

This test on the cells shall be carried out in accordance with IS 9000 (Part 7/Sec 3) : 1979 with height of drop as 100 mm and number of drops shall be 3.

8.13.7 *Toppling Test*

This test on the cells shall be carried out in accordance with IS 9000 (Part 7/Sec 3) : 1979.

8.13.8 *Bump Test*

This test on the cells shall be carried out in accordance with IS 9000 (Part 7/Sec 2) : 1979.

ANNEX A

(*Clause* 2.1)

LIST OF REFERRED INDIAN STANDARDS

IS No.	*Title*
203 : 1984	Specification for dry batteries for flashlights (*fourth revision*)
1885 (Part 8) : 1965	Electrotechnical vocabulary: Part 8 Secondary cells and batteries (*first revision*)
2576 : 1975	Specification for dry batteries for transistor radio receivers (*first revision*)
8144 : 1976	Specification for multipurpose dry batteries
8320 : 1982	General requirements and methods of test for lead-acid storage batteries (*first revision*)
9000 (Part 3/ Sec 1) : 1977	Basic environmental testing procedures for electronic and electrical items: Part 3 Dry heat test, Section 1 General
9000 (Part 3/ Sec 2) : 1977	Basic environmental testing procedures for electronic and electrical items: Part 3 Dry heat test, Section 2 Dry heat test for non-heat dissipating items with sudden change of temperature
9000 (Part 3/ Sec 3) : 1977	Basic environmental testing procedures for electronic and electrical items: Part 3 Dry heat test, Section 3 Dry heat test for non-heat dissipating items with sudden change of temperature
9000 (Part 3/ Sec 4) : 1977	Basic environmental testing procedures for electronic and electrical items: Part 3 Dry heat test, Section 4 Dry heat test for heat dissipating items with sudden change of temperature
9000 (Part 3/ Sec 5) : 1977	Basic environmental testing procedures for electronic and electrical items: Part 3 Dry heat test, Section 5 Dry heat test for heat dissipating items with gradual change of temperature
9000 (Part 5/ Sec 1) : 1981	Basic environmental testing procedures for electronic and electrical items: Part 5 Damp heat (cyclic) test, Section 1 16 + 8 h cycle
9000 (Part 7/ Sec 2) : 1979	Basic environmental testing procedures for electronic and electrical items: Part 7 Impact test, Section 2 Bump
9000 (Part 7/ Sec 3) : 1979	Basic environmental testing procedures for electronic and electrical items: Part 7 Impact test, Section 3 Drop and topple
9000 (Part 8) : 1981	Basic environmental testing procedures for electronic and electrical items: Part 8 Vibration (sinusoidal) test
9000 (Part 12) : 1981	Basic environmental testing procedures for electronic and electrical items: Part 12 Dust test
9000 (Part 13) : 1981	Basic environmental testing procedures for electronic and electrical items: Part 13 Low air pressure test

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Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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